

Biodiesel Economics

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Cost estimation- Three Questions

1. **What does a biodiesel plant cost?**
2. **What will it cost you to produce the biodiesel?**
3. **How does your production cost relate to selling price?**



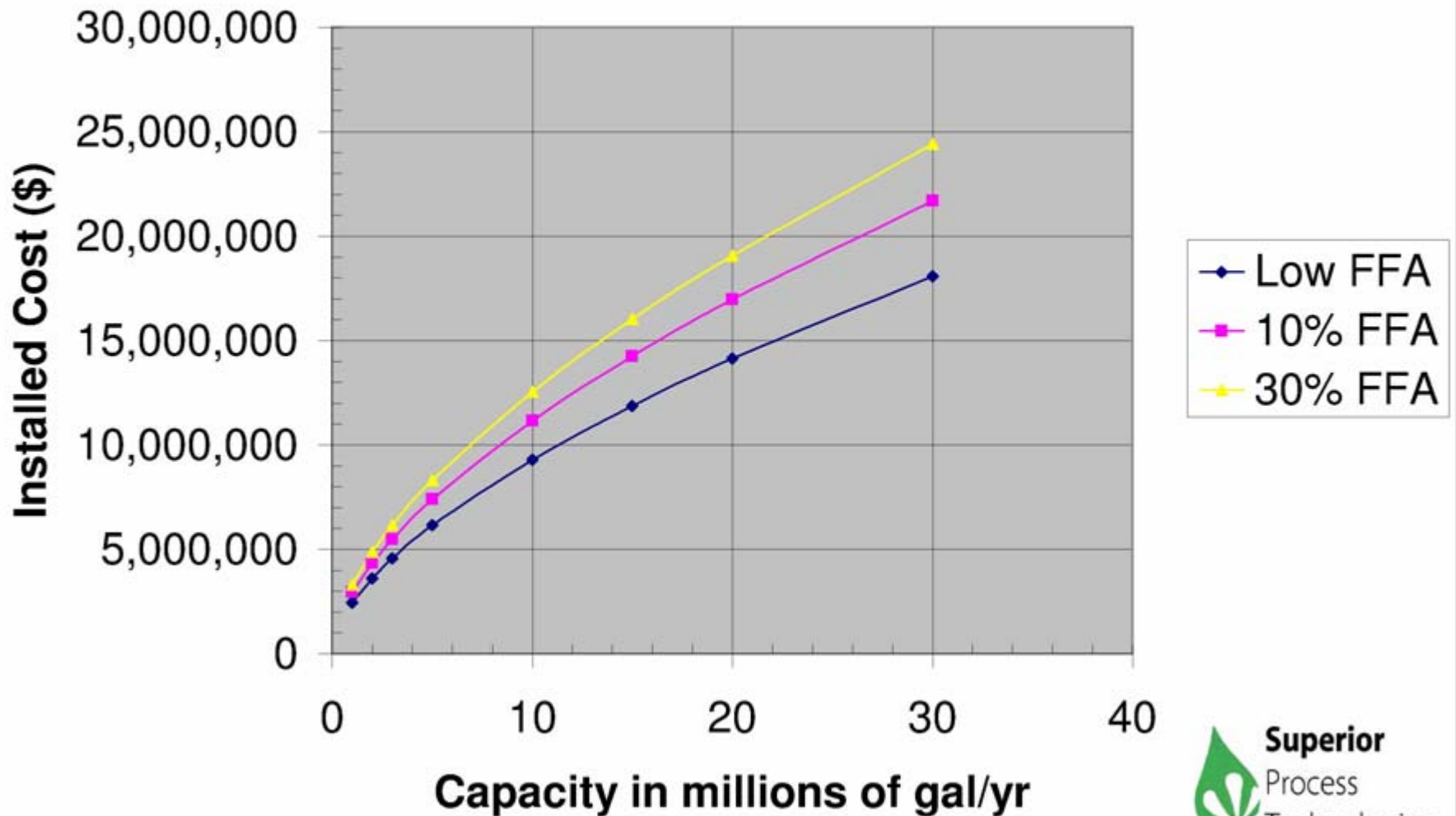
Plant Cost- Buy

- Are you going to buy a turn-key plant from a technology provider such as Lurgi, REG, Crown, Superior Process, etc.?
 - Most expensive but quickest option.
 - If it is their first plant, you should expect a substantial discount.

Plant cost- Build Your Own

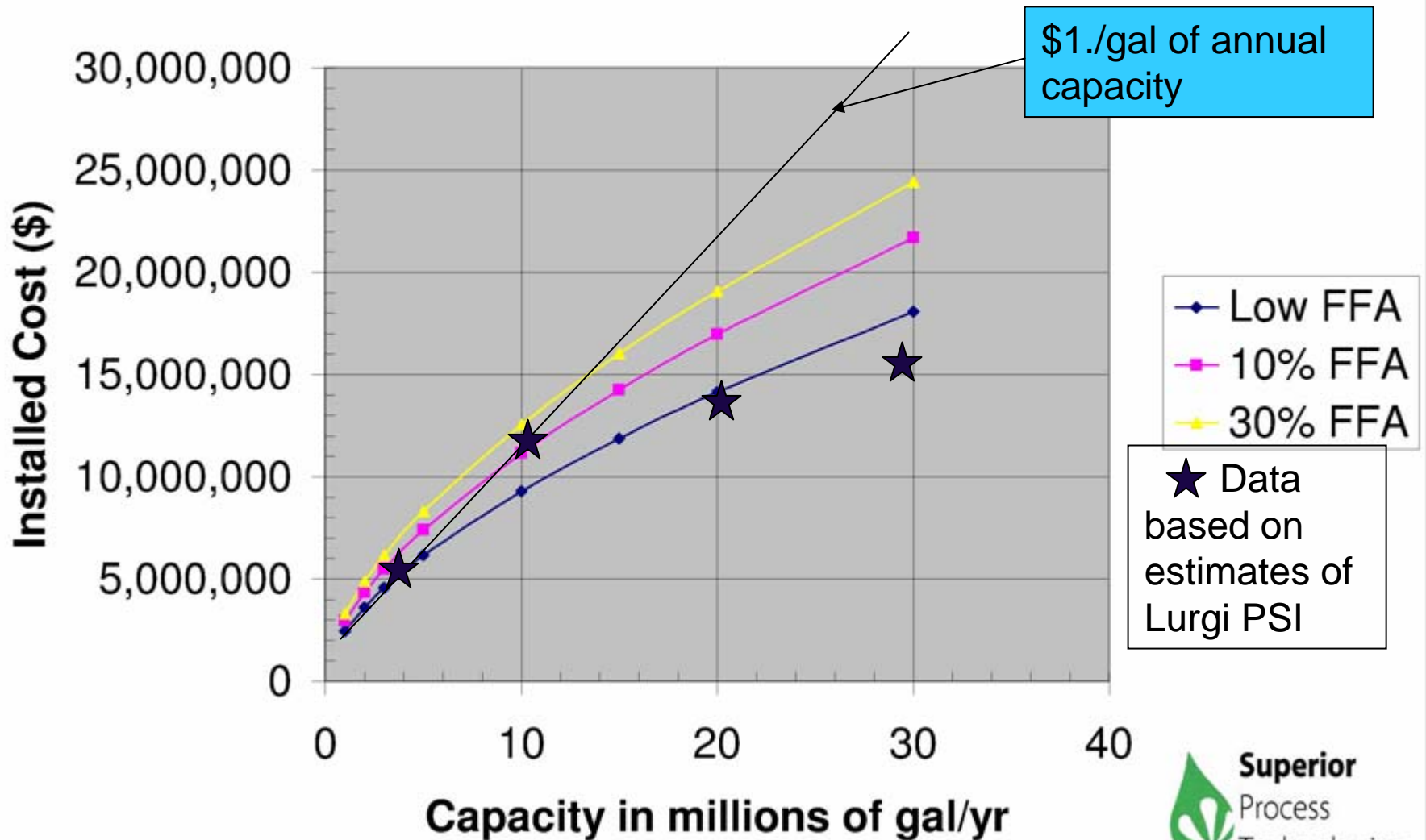
- Are you going to design and build your own plant?
 - Least expensive (maybe) but longest time due to need for development.
 - Should be able to take advantage of used or existing equipment.
- Some combination of these two options.

Biodiesel Plant Budget Installed Cost



Add about 20% to cost due to rise in steel prices, 10/07

Biodiesel Plant Budget Installed Cost



Biodiesel Production Cost

(5 million gallon plant)

	<u>Unit Cost</u>	<u>\$/gal</u>
Oil	\$0.38/lb	\$2.85
Methanol	\$1.15/gal	\$0.14
Catalyst (25% NaOCH ₃)	\$0.55/lb	\$0.08
Neutralizer (HCl)	\$0.08/lb	\$0.01
Nat. gas + electricity	\$9./mmbtu, \$0.05/kwh	\$0.02
Labor	1 shift, 5 people	\$0.04
Depreciation/interest	10 yr/6%	\$0.15
Maintenance	3.8% of plant	\$0.04
Admin. + overhead		<u>\$0.02</u>
Total:		\$3.35

Note that the oil is 85% of production cost, infrastructure is only 5% of production cost. Production cost is \$0.50/gal + oil.

Biodiesel Retail cost

Producer

Production cost	\$3.35/gallon
Producer profit	\$0.00
Small producer tax credit	-\$0.10
CCC credit	0
Transportation	<u>\$0.08</u>
Distributor purchase price	\$3.33

Distributor/blender

Purchase price	\$3.33/gallon
Excise tax credit	-\$1.00
Idaho+Federal tax	\$0.494
Freight	\$0.08
Blender profit	<u>\$0.05</u>
Retailer purchase price	\$2.95

Retailer

Purchase price	\$2.95/gallon
Retailer mark-up	<u>\$0.12</u>
Retail price (B100)	\$3.07

- Assumes CCC program expires in 2006.

- Assumes no credit for glycerin.

With current incentives, biodiesel should break even with diesel fuel when retail prices are above \$3.07/gallon.

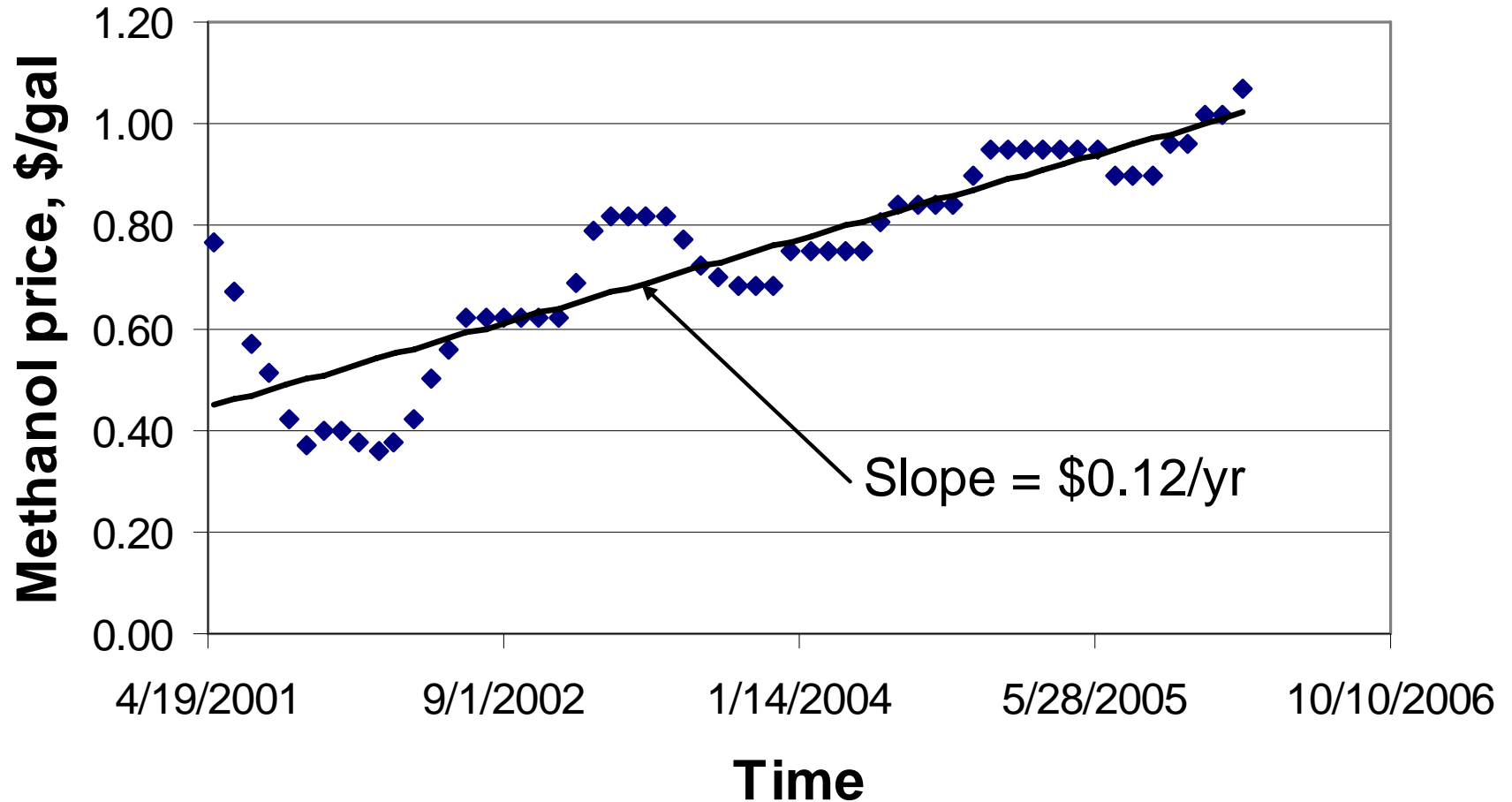
Oil Price

- Oil is difficult to find if you haven't locked in a supply.
- If you are already a crusher, the internal transfer price is a business issue relating to where the profits should appear.
- If you are buying oil, expect to pay CBOT price plus freight (\$0.01-0.03/lb).
- With recycled greases, collection and waste disposal costs mean the oil is not "free."

Methanol prices

- The reaction consumes about 0.11 lb methanol per lb of biodiesel.
- $0.11 \times 7.3 \text{ lb/gal} = 0.80 \text{ lb methanol/gal biodiesel}$
- $0.80 \text{ lb} / 6.6 \text{ lb/gal methanol} = 0.12 \text{ gal methanol per gallon of biodiesel}$
- $0.12 \text{ gal} \times \$1.15/\text{gal} = \$0.14/\text{gal biodiesel}$
- But remember we are using 100% excess methanol. Can we recover all of this? This depends on your plant design.

Methanex Monthly average price



Catalyst

- Using 2% sodium methyllate solution (25%)
 - If a lb of oil gives a lb of biodiesel and 1 gallon of biodiesel is 7.3 lb:
 - $7.3 \text{ lb/gallon} \times 0.02 \text{ lb cat/lb bio} \times \$0.55/\text{lb cat}$
 $= \$0.08/\text{gallon biodiesel}$
- Using 1% sodium hydroxide
 - $7.3 \text{ lb/gallon} \times 0.01 \text{ lb cat/lb bio} \times \$0.42/\text{lb cat}$
 $= \$0.03/\text{gallon biodiesel}$

Neutralizers and other production inputs

- Need to neutralize catalyst and split soaps. Typically use 1% HCl in water.
- Energy costs will depend on process but are usually small unless using high temperature processes (heterogeneous catalyst or supercritical).



Labor

- Estimate about 1 plant operator per million gallons.
- Half a manager per two employees. Try to leverage this with other businesses (soybean crushing, etc.)

For example:

- 2 employees @\$30K, 0.5 manager @\$50K
- $\$85K / 2 \text{ million gallons} = \$0.04/\text{gallon}$

Depreciation- Expensing the Assets

- Land can't be depreciated.
 - Building might be 20 or 25 years.
 - Equipment is typically 7 or 10 years.
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- If a 10 million gallon, \$9 million plant is depreciated over 10 years, this is \$0.09/gallon.

Business Models

- **Large centralized plant**
 - Lower operating cost (main savings is labor and cost of capital)
 - More transportation cost
- **Small decentralized plant**
 - Higher operationing cost
 - Reduced transportation (It is quite feasible to make up for a \$0.10/gallon penalty on the plant operating cost with lower transportation costs)

Business Models

- Most plants try to leverage local advantages such as building next to an existing crush plant.
 - Close proximity to oil
 - Can share marketing, management, lab facilities
- Might also locate close to petroleum distribution or close to meal market.

Business Models

- **Tying up an oil supply is important to weather current industry shake-out.**
- **Suggested approach:**
 - **Start by buying and reselling biodiesel in your area.**
 - **Is the market there? Make sure you can sell the product before you invest in making it.**

